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Introduction

One of the major constraints to developing comprehensive conservation programs for migratory birds is the lack of knowledge linking breeding, stopover and wintering areas. Use of stable isotope chemistry, satellite telemetry, genetic analyses are providing initial and important suggestions for broad-scale linkages (Webster et al. 2002) but there is often insufficient resolution for conservation programs to apply this information at a site or landscape scale. Thus, data on individually marked birds can be helpful for the fine scale spatial resolution frequently needed to make conservation decisions.

Development of a comprehensive conservation program to protect the endangered Kirtland's Warbler (*Dendroica kirtlandii*) requires protecting breeding and wintering grounds and migratory stopover sites. The results presented here are part of a comprehensive program to protect the endangered Kirtland's Warbler on its breeding and wintering ground, including The Kirtland's Warbler Research and Training Program which has initiated studies of habitat requirements of over wintering Kirtland's Warblers in The Bahamas.

A key step toward development of a comprehensive program involves evaluating the degree of linkage between specific breeding and wintering areas of Kirtland's Warblers. The immediate purpose of this work is to determine if birds banded on the Eleuthera, Bahamas wintering areas are also associated with each other on the Michigan breeding grounds. Thus, the focus of this work was to search occupied areas throughout the breeding range to locate as many of these banded birds as possible to further this objective. Ultimately, we expect these data will also help us to better evaluate Kirtland's Warblers survival, correlate arrival dates of Kirtland's Warblers with condition of Kirtland's Warblers immediately prior to spring migration, and to document duration of migration for individual birds. In addition, future surveys to locate banded birds could provide a second estimate of the number of singing males present in occupied stands for comparison to the estimates derived from established line transect count methods.

Our work builds on studies conducted by Haney et al. (1998) and Sykes and Clench (1998). Here we report on that part of our work focused on banded birds that were located in both The Bahamas and Michigan.

Methods

Kirtland's Warbler sites in the Lower Peninsula were searched for birds which had been banded in The Bahamas. Guidelines, specified by Federal Endangered Species Permit PRT-697830 (subpermit 04-09) and reviewed by members of the Kirtland's Warbler

Recovery Team and others, were provided to a team of observers to ensure that surveys were a minimal source of disturbance to Kirtland's Warblers. These guidelines included instructions that no playback was to be used to attract birds, observers were to retreat from birds that appeared to be agitated by the presence of observers, and to travel through sites using a route least likely to disturb Kirtland's Warblers (e.g. avoid edges of openings). We checked each site, or part of a site, only once. We only deviated from this approach when checking arrival dates of banded birds as multiple visits to a site were needed until either the individual arrived or we concluded that the bird did not arrive. Checking of sites was coordinated by D. Ewert with observers instructed to report back as soon as they had completed a survey of an area; see Appendix 3 for suggested improvements for any future survey work.

Sites were surveyed from 11 May through 19 June 2004. Observers were assigned to particular sites or groups of sites. We focused on the largest sites to increase efficiency in locating birds. We usually checked each site or area once. Observers walked slowly through the sites, following roads and residual two-tracks whenever possible, checking for bands on each bird. Most surveys were conducted during the morning (0630-1100), when singing was most active (singing declined rapidly after 1000). A few surveys were completed in the afternoon or early evening. The location of each banded bird was mapped on topographic maps and/or recorded with GPS units. Sites were not visited more than twice and birds were typically not followed for more than 30 minutes and only rarely for up to one hour. There was little evidence that birds responded to the observers; males typically sang and foraged and females were rarely seen. When birds did appear to react to the presence of an observer, the observer ceased attempting to watch the bird and moved to another bird.

Immediately after the survey attempts were made to capture the eight Bahamian-banded Kirtland's Warblers which had been found. Five were captured and crown feathers pulled for isotope analysis.

Results

A total of 371 Kirtland's Warblers (361 males, 10 females; 27% of the 1,341 singing males located during the 2004 official census) were observed sufficiently well to determine their banding status; nine of these 371 birds (approximately 2%) were banded (Appendix 2). Eight had been color-banded in The Bahamas (see Table 1). We located one other bird we presumed had been banded in Michigan (the bands were highly faded) but the bird could not be identified. The eight birds banded in The Bahamas represent approximately 15 % of all the Kirtland's Warblers banded in The Bahamas from March 2002-April 2004. Because some of the Bahamian-banded birds had probably died by spring 2004 so the proportion of surviving birds banded in The Bahamas which were located in Michigan probably exceeded 15%.

Surveys for Kirtland's Warblers in Michigan's Upper Peninsula, conducted by others, did not reveal any birds banded in The Bahamas. Of nine males (birds) located in the Upper Peninsula, seven were unbanded, the banding status of one bird was not determined, and

One bird apparently had been banded in the Upper Peninsula (Steve Sjogren, pers. comm.). Two females, both unbanded, were also found in the Upper Peninsula. These data are not presented in Appendices 1 and 2.

One Kirtland's Warbler banded in The Bahamas (YX-YY, see Table 1), was found in Michigan in both 2003 and 2004. This bird was not seen in The Bahamas during the 2003-2004 winter. It was first seen 11 May 2004 at the same site where it had been found in 2003 by Phil Huber and others. Other Kirtland's Warblers banded in The Bahamas, and found in Michigan in 2003 were not relocated: 2131-75803 (-XB) was not seen 13 May 2004 or on subsequent dates at its 2003 location and the Mensing bird (-XXW), presumed to have been banded in The Bahamas, was not found.

The first singing male Kirtland's Warblers were noted on 10 May 2004 by Chris Mensing (Bald Hill, Crawford County) and Carl Racchini (Yellow Bird, Pine River). By 13 May 2004 it was estimated that at least 50% of the Kirtland's Warbler males had returned to the Michigan breeding grounds. Joe Gamola noted the first female on 15 May 2004 at McKinley; females were more generally observed by 21 May 2004. By 11 June we noted Kirtland's Warblers carrying food.

218.25 person-hours were spent searching the following sites for banded Kirtland's Warblers in 2004: Big Creek (USFS), Burton's Landing, Damon, El Dorado, Fletcher Road, Leota, Lovells/Townline/Big Creek Michigan DNR Kirtland's Warbler Management Area, Mack Lake, McKinley, North Down River/Stephan's Bridge, Guide's Rest, Pine River (Chamber's Road, Daffy Duck, Dinosaur Valley, Fallen Timber, Green Sale, Lorenz Road East, Lost Road North, Powerline, Steven's Corner, Yellow Bird) (see Appendix 1). The total number of birds recorded by observers each day exceeds the total number of individuals observed because some birds were seen on more than one day.

Three of the banded Kirtland's Warblers found in Michigan during the 2004 breeding season were last noted at their Eleuthera study sites on the following dates: YX-YB (Elosite4, 26 April); BB-XR (Elosite4, 28 April); XB-YY (Elrsite2, 4 February). We do not have arrival dates for these birds but these individuals will be among the birds we hope to monitor for arrival dates assuming these same birds can be located in spring 2005.

Kirtland's Warblers color-banded on Eleuthera were located at five sites in Michigan's Lower Peninsula (see Table 1); the maximum distance between color-banded birds was approximately 55 miles (92 km). Of the two birds banded at Elosite4, Eleuthera in 2004, one was found 27.5 miles (46 km) from the other in Michigan. Similarly, the three birds banded at Elrsite2 all were found at different sites in Michigan and the two birds banded at Elgsite3 were also found at different Michigan sites. The distance between the wintering sites of Kirtland's Warblers on Eleuthera, and found in Michigan in 2004, is summarized in Table 2.

Table 1. Winter and summer locations of Kirtland's Warblers banded in The Bahamas. Bahamas dates are banding dates. All birds resighted in Michigan were males.

Individual		Site (date found)	
Band number	Color Bands	Bahamas	Michigan
2131-75813	YY-YA	Elgsite3 (23 Mar. 2003)	Big Creek, Oscoda Co. (11 May 2004)
2131-75821*	AR-YY	Elrsite1 (22 Oct. 2003)	Fletcher Road, Crawford Co. (7 June 2004)
2131-75822	AO-OB	Elrsite1 (13 Nov. 2003)	North Down River, Crawford Co. (22 May 2004)
2131-75824	YB-YA	Elosite4 (28 Mar. 2004)	Pine River, Daffy Duck E., Alcona Co. (29 May 2004)
2131-75835*	YY-AB	Elrsite1 (24 Nov. 2003)	Pine River, Powerline S., Iosco Co. (18 June 2004)
2131-75837*	RA-OY	Elgsite3 (9 Nov. 2003)	Fletcher Road, Crawford Co. (27 May 2004)
2131-75853*	AR-BB	Elosite4 (19 Mar. 2004)	Big Creek, Oscoda Co. (9 June 2004)
1540-22886*	A-Y	Tarpum Bay (18 Mar. 2002)	Pine River, Rearing Pond S., Alcona Co. (27 May 2004)

* Bird netted, crown feathers collected, band number confirmed

Table 2. Approximate distance (miles) between the Eleuthera sites that supported Kirtland's Warblers found in Michigan in 2004.

	Elmsite1	Elrsite2	Elgsite3	Elosite4
Elmsite1		4.6 (7.6 km)	17.6 (29.3 km)	19.1 (31.8 km)
Elrsite2			13 (21.7 km)	14.5 (24.3 km)
Elgsite3				3.3 (5.5 km)

Discussion

It is important, and exceedingly difficult, to document both breeding and wintering locations of individual birds. The greatest opportunities for such documentation are for species, or populations of species, with highly restricted breeding and wintering ranges and that are intensively surveyed. As such a species, the Kirtland's Warbler represents an extremely unusual case in which it is logistically feasible to conduct intensive surveys of breeding colonies to search for birds banded on the less-well known winter habitats. Our relatively conservative estimate of locating 15% of the banded birds wintering on Eleuthera, The Bahamas, that were still alive prior to spring migration of 2004 compares favorably with recovery rates achieved through the radio telemetry methods that have been used to link breeding and wintering habitats for larger species which concentrate in particular habitats, such as shorebirds (e.g., 24% of 132 Western Sandpipers (*Calidris mauri*); Bishop and Warnock, 25% of 40 Pacific Golden Plovers (*Pluvialis fulva*); Johnson et al. 2001). In addition, surveys for color-banded warblers can be done

repeatedly (e.g., following every migration period), whereas radio telemetry techniques are typically limited to a number of weeks.

Although exceedingly rare, there have been a few documented cases of individual banded birds being located on both winter and breeding habitats. Sykes (unpubl. data) located one banded male Kirtland's Warbler near Governor's Harbour, Eleuthera during two winters (see Sykes and Clench 1998) that was found for three summers at Bald Hill, Crawford County, Michigan. This is the only record of a known individual Kirtland's Warbler found on both the wintering and breeding grounds.

There are few other cases where individual birds have been located on both breeding and wintering ranges. One Southwestern Willow Flycatcher (*Empidonax traillii extimus*) banded in Ash Meadows National Wildlife Refuge, Nevada was relocated in Guanacaste province, Costa Rica and another bird banded in Gila County, Arizona was also relocated in Guanacaste, Costa Rica ((Koronkiewicz and Sogge 2002, Mary Whitfield, pers. comm.). The bird banded in Arizona returned to the same Costa Rica site in two consecutive winters. In addition, one color-banded Bicknell's Thrush (*Catharus bicknelli*), a species that like the Kirtland's Warbler has a small population and restricted wintering range, was observed on territory in winter in the Dominican Republic after being banded as a yearling in Vermont (Rimmer and McFarland 2001). In their documentation of this bird, Rimmer and McFarland note that although observations of marked shorebirds and some raptors in winter are more common, the USGS Bird Banding Lab only had documentations of 15 individual birds found in both winter and summer. They cite the observation of a single Ovenbird (*Seiurus aurocapillus*) banded in Pennsylvania and relocated in Belize (Dowell and Robbins 1998) as the only other published example by 2001 and list the unpublished Kirtland's Warbler described above, as well as two Least Bell's Vireos (*Vireo bellii pusillus*) banded in southern California and later observed in Baja Mexico (B. Kus, unpublished data, as cited in Rimmer and McFarland), and an Indigo Bunting (*Passerina cyanea*) banded in Michigan and relocated in Campeche, Mexico (D. Dawson, unpublished data, as cited in Rimmer and McFarland 2001)

Although information as single or few individual records, these other examples of linking banded passerines are basically chance encounters, rather than the result of systematic search efforts. The ability to systematically search for banded Kirtland's Warblers is thus a major contribution made possible by the intensive winter banding and habitat use work done by the Kirtland's Warbler Research and Training Program.

Although our sample size is very small, these data suggest that Kirtland's Warblers overwintering at the same site breed at two or more different sites. There is no tight linkage between wintering and breeding areas at such a fine spatial scale. This is consistent with the dispersal of birds on the Michigan breeding grounds as individuals have been documented to breed at different sites in different years and nestlings have been located up to 676 km from their natal site (Walkinshaw 1983). This result also is in agreement with stable isotope work on Bicknell's Thrush (Hobson et al. 2001) and Black-throated Blue Warblers (*Dendroica caerulescens*; Chamberlain et al. 1997) that suggest that other

migratory songbirds that breed in different regions of species' ranges mix at wintering sites.

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This work is an extension of the intensive banding and other efforts of the Kirtland's Warbler Research and Training program on Eleuthera, The Bahamas.

References

- Chamberlain, C.P., J.D. Blum, R.T. Holmes, X.H. Feng, T.W. Sherry, and G.R. Graves. 1997. The use of isotope tracers for identifying populations of migratory birds. *Oecologia* 109:132-141.
- Dowell, B.A. and C.S. Robbins. 1998. Wintering ovenbird from Belize recovered on Pennsylvania breeding ground. *North Amer. Bird Bander* 23:109.
- Haney, J.C., D.S. Lee and M. Walsh-McGehee. 1998. A quantitative analysis of winter distribution and habitats of Kirtland's Warblers in The Bahamas. *Condor* 100:201-217.
- Hobson, K.A., K.P. McFarland, L.I. Wassenaar, C.C. Rimmer, and J.E. Goetz. 2001. Linking breeding and wintering grounds of Bicknell's Thrush using stable isotope analyses of feathers. *Auk* 118:16-23.
- Koronkiewicz, T.J. and M.K. Sogge. 2002. Southwestern Willow Flycatchers recaptured at wintering sites in Costa Rica. *North American Bird Bander* 26:161-162.

Rimmer, C.C. and K.P. McFarland. 2001. Known breeding and wintering sites of a Bicknell's Thrush. Wilson Bull. 113:234-236.

Sykes, P.W., Jr. and M.H. Clench. 1998. Winter habitat of Kirtland's Warbler: an endangered nearctic/neotropical migrant. Wilson Bulletin 110:244-261.

Walkinshaw, L.H. 1983. Kirtland's Warbler: the natural history of an endangered species. Cranbrook Institute of Science, Bloomfield Hills, MI, 207 pp.

Webster, M.S., P.P. Marra, S.M. Haig, S. Bensch and R.T. Holmes. 2002. Links between worlds: unraveling migratory connectivity. Trends in Ecol. and Evol. 17:76-83.

Appendix 1. Sampling effort and number of birds observed by site and date.

Site	Date	Person Hours	Observer(s)	Number KWs
Big Creek KWMA (Federal, Oscoda Co.)				
T25N, R2E, Sect. 19,20	3 June	4	D. Ewert/I. Miller	6
T25N, R2E, Sect. 19	8 June	3	D. Ewert	11
T25N, R2E, Sect. 20	9 June	1.5	D. Ewert	3
T25N, R1E, Sect. 23,24	9 June	1	D. Ewert	4
T25N, R1E, Sect. 23,24	9 June	2	D. Ewert/I. Miller	6
Burton's Landing (Crawford Co.)				
T26N, R3W, Sect. 11	5 June	0.5	D. Ewert	1
Damon (Ogemaw Co.)				
T24N, R2E, Sect. 7, 32	13 May	8	D. Ewert/I. Miller	9
T24N, R1E, Sect. 20, NE ¼	21 May	9.5	D. Ewert/I. Miller	29
T24N, R2E, Sect. 7	3 June	7	D. Ewert/I. Miller	8
T24N, R2E, Sect. 11	3 June	4	D. Ewert/I. Miller	2
T24N, R2E, Sect. 5,6	4 June	7	D. Ewert/I. Miller	10
T24N, R1E, Sect. 22	10 June	3	D. Ewert, I. Miller	5
T24N, R1E, Sect. 20, NW1/4	11 June	10.5	D. Ewert/I. Miller	30
T24N, R1E, Sect. 20, SE1/4	11 June	3.25	M. Petrucha	13
T24N, R1E, Sect. 20, NW1/4	13 June	4.75	D. Ewert	29
Eldorado KWMA (Crawford Co.)				
T25N, R1W, Sect. 23	21 May	0.75	D. Ewert	2
T25N, R1W, Sect. 22,23	19 June	1	D. Ewert	3
Fletcher Rd. (Crawford Co.)				
T25N, R4W, Sect. 30	27 May	3	R. Perez	10
T25N, R4W, Sect. 19	7 June	2	R. Perez	4
Horsecamp East (Crawford Co.)				
T26N, R2W, Sect. 32	5 June	2	M. Petrucha	8

Leota (Clare Co.)				
T20N, R6W, Sect. 7,13,18	15 June	6.75	K. Hall	22
T20N, R6W, Sect. 13, 23,24	17 June	3.75	M. Hamas	7
Lovells KWMA (Crawford Co.)				
T27N, R1E, Sect. 5.6	14 June	5	D. Ewert	19
T28N, R1E, Sect. 30,31	"		"	
T27N, R1E, Sect. 5.6	15 June	5	D. Ewert	19
T28N, R1E, Sect. 5.6	"		"	
T28N, R1W, Sect. 14,15,22,23	16 June	3.75	D. Ewert	18
Mack Lake KWMA (Oscoda Co.)				
T25N, R3E, Sect. 1	14 May	9	D. Ewert/I. Miller	2
T25N, R2E, Sect. 11	3 June	4	D. Ewert/I. Miller	2
McKinley KWMA (Alcona Co.)				
T26N, R5E, Sect. 16-21	20 May	10	D. Ewert/I. Miller	13
T27N, R4E, Sect. 36	"		"	
T26N, R5E, Sect. 31	"		"	
T26N, R4E, Sect. 1	"		"	
T26N, R5E, Sect. 6	"		"	
T26N, R5E, Sect. 21	18 June	1	D. Ewert	2
North Down River/Stephan's Bridge/Guide's Rest (Crawford Co.)				
T27N, R1W, Sect. 20,29,30	22 May	6.5	D. Ewert	14
T27N, R2W, Sect. 25	"		"	
T27N, R1W, Sect. 25	28 May	2	R. Perez	5
T26N, R2W, Sect. 5.6	1 June	2	R. Perez	9
T27N, R1W, Sect. 19,20,29,30	5 June	5	D. Ewert	8
T27N, R1W, Sect. 25	5 June	2	R. Perez	21
Pine River KWMA (Alcona Co.)				
Lost Rd. N, T25N, R7E, Sect. 20	26 May	3	J. Stevens	3
Rearing Pond S., T25N, R7E, Sect. 31	27 May	4	J. Stevens	4
Steven's Corner W., T25N, R7E, Sect. 28	28 May	4.75	J. Stevens	3
Daffy Duck E., T25N, R7E, Sect. 10	29 May	6.25	J. Stevens	8
Green Sale, T25N, R7E, Sect. 25	1,3 June	8.5	J. Stevens	6
Fallen Timber E., T25N, R7E, Sect. 28	3, 4 June	10.25	J. Stevens	10
Fallen Timber W., T25N, R7E, Sect. 29	5 June	3	J. Stevens	5
Pine River KWMA (Iosco Co.)				
Chambers S., T24N, R6E, Sect. 13	26 May	1.25	J. Stevens	0
Lorenz Rd. E., T24N, R7E, Sect. 4	11 June	6	J. Stevens	7
Dinosaur Valley, T24N, R7E, Sect. 1,2	12-14 June	12.5	J. Stevens	14
Yellow Bird S., T24N, R7E, Sect. 7	18 June	2.5	D. Ewert	6
Powerline, T24N, R7E, Sect. 1,12	18,19 June	13.5	J. Baumgartner P. Thompson	34
Total		218.8		154

Appendix 2. Estimated number of Kirtland's warblers (banded versus unbanded), located by site. Number of birds/site is less than the total number of birds indicated in Appendix 1 as some birds were counted on more than one day.

<u>Site</u>	<u>Number unbanded birds</u>		<u>Number banded birds</u>	
	<u>Males</u>	<u>Females</u>	<u>Males</u>	<u>Females</u>
Big Creek (Federal)	24	1	2	0
Burton's Landing	1	0	0	0
Damon	103	2	1	0
Eldorado	4	0	0	0
Fletcher	12	1	2	0
Leota	28	1	0	0
Lovells KWMA	49	2	0	0
Mack Lake	4	0	0	0
McKinley	13	0	0	0
North Down River	16	2	1	0
Pine River	98	1	3	0

Appendix 3. Suggestions for improving future census work

1. Ensure that a GPS reading is taken for all banded birds. Conduct a GPS training session prior to arrival of Kirtland's Warblers.
2. Secure permits early.
3. Revise data sheet to include columns for beginning and ending time of survey work, number of both unbanded and banded males and females seen on each survey, name of observer. Attach a map so observers can trace their route.
4. Ensure all parties know who is checking which area.
5. Focus survey effort during the period of 17 May-10 June to avoid the nesting period. Document date of first arrival, 8-17 May, for a small subset of birds.
6. Revise guidelines to describe how to best sample birds.
7. Flag area and/or note landmarks if GPS is not available for relocation of birds; ensure banders talk with original observer before seeking to locate a bird.